Pinhole Surgical Technique Versus Vestibular Incision Subperiosteal Tunnel Access Technique in Conjunction with Collagen Membrane in the Treatment of Cairo Type 1 Isolated Gingival Recession Defects

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Abstract

Purpose: The aim of the present study was to clinically compare between the effectiveness of pinhole surgical technique (PST) and vestibular incision subperiosteal tunnel access technique (VISTA) in conjunction with collagen membrane in the treatment of type 1 single isolated gingival recession defects according to Cairo et al classification. **Methods**: This study includes 20 patients. Cases were distributed into two main groups, group I was treated with vestibular incision subperiosteal tunnel access (VISTA) technique in conjunction with collagen membrane, while group II was treated by pinhole surgical technique in conjunction with collagen membrane. Clinical assessment was caried out at baseline including the following parameters: probing depth (PD), clinical attachment level (CAL), keratinized tissue width (KTW), gingival thickness (GT), recession depth (RD). Re-evaluation of theses parameters was carried out after three and six months, while evaluation of pain score using visual analogue scale (VAS) was carried out after 24 hours, 72 hours, first and second week of surgery. **Results**: Both groups recorded statistically significant improvements from baseline in decreased recession depth, gain in clinical attachment levels and increase in gingival thickness. However, there was no statistically significant difference between VISTA and PST regarding PD, CAL, RD, KTW, GT, and VAS score. **Conclusions**: Both VISTA and PST when combined with collagen membrane were successful in the management of Cairo's type 1 single isolated gingival recession defects.

Introduction:

Marginal tissue recession is defined as the displacement of the soft tissue mar-gin apical to the cementoenamel junction (CEJ)[1]. Gingival recession is a prevalent condition observed in many patients. While some may be unaware of its presence, others may recognize it but feel unconcerned, whereas a portion of patients express concern and seek corrective treatment. Typically, patients present with three primary issues related to gingival recession: dissatisfaction with aesthetics, anxiety about possible tooth loss, and dentine hypersensitivity resulting from the exposed root surface [2].

To aid in the diagnosis of gingival recessions, a number of classifications have been put out in the literature, including the Sullivan and Atkins (1968), Miller (1985), Smith index (1990), Mahajan classification (2010), Cairo et al. (2011) [3].

In 2011 Cairo and his associates [4] put on the following classification of gingival recession in relation to interdental clinical attachment loss: Recession type 1 (RT1): gingival recession with no loss of inter-proximal attachment. Interproximal CEJ was clinically not detectable at both mesial and distal aspects of the tooth. Recession type 2 (RT2): gingival recession associated with loss of inter-proximal attachment. The amount of interproximal

attachment loss was less than or equal to the buccal attachment loss. Recession Type 3 (RT3): Gingival recession associated with loss of inter-proximal attachment. The amount of interproximal attachment loss was higher than the buccal attachment loss [4].

The successful coverage of exposed roots for both aesthetic and functional purposes has been the goal of various mucogingival procedures. Multiple techniques have been developed to achieve predictable root coverage. These advancements aim to enhance predictability, reduce patient discomfort, minimize the number of surgical sites, and meet the patient's aesthetic expectations, including the final color and tissue integration of the grafted area [5].

Currently, the gold standard technique for root coverage correction is the combination of a subepithelial connective tissue graft (SCTG) and a coronally advanced flap (CAF). However, this approach involves creating a second surgical site, which increases patient morbidity, and requires vertical releasing incisions, leading to scar formation that compromise aesthetics [6].

To avoid these disadvantages, the vestibular incision subperiosteal tunnel access approach was developed by Zadeh HH [7] and was combined with collagen membrane [8]. Following the similar concept, a novel minimally invasive technique called the pinhole surgical technique (PST) was introduced by Chao in 2012 [9]. These techniques offers an advantage by preserving the blood supply from both the overlying flap and the underlying periosteal bed, without compromising vascularity due to the dissection of papillae [6].

A major problem with non-resorbable membranes is that a second surgical procedure is needed to remove the membrane, which may jeopardize healing and clinical outcomes [10, 11]. Studies comparing the efficacy of non-resorbable and bioabsorbable barrier membranes in the treatment of the gingival recession have shown no difference in clinical outcomes [12, 13]. Therefore, bioabsorbable membranes such as collagen are generally preferred.

One of the key benefits of using collagen membranes in the treatment of gingival recession is their ability to increase tissue volume. As the membrane is absorbed, it is gradually replaced by the host's own tissue, which helps promote the regeneration of keratinized gingiva. This regenerative process not only enhances aesthetic outcomes but also contributes to functional healing. Additionally, collagen membranes play a role in reducing common complications observed in other regenerative procedures, such as membrane exposure or wound infection. These advantages make collagen membranes an effective and less invasive option for root coverage and gingival tissue regeneration [14].

Thus the purpose of this study was to clinically compare between the effectiveness of vestibular incision subperiosteal tunnel access technique (VISTA) and pinhole surgical technique (PST) in conjunction with collagen membrane in the treatment of type 1 single isolated gingival recession defects according to Cairo et al [4] classification.

Subjects and methods

Study population: A total of twenty participants were selected from the outpatient clinic in the department of Oral Medicine and Periodontology, Faculty of Dentistry, Mansoura University. All participants had thorough clinical examination and were given all the information available about the treatment that they will receive and steps to be done including possible risks, and other treatment options. This trial was conducted to compare between the effectiveness of pinhole surgical technique and vestibular incision subperiosteal tunnel access Technique in conjunction with collagen membrane in the treatment of type 1 single isolated gingival recession defect according to Cairo et al classification. Study protocol was approved by the ethical committee, Faculty of Dentistry, Mansoura University with approval number A09061222. Written informed consents were taken from all patients. Patients were informed about the benefits, risks, complications and follow up times before treatment.

Selection Criteria: Patients above 18 years old with type 1 gingival recession according to Cairo et al classification and with recession depth ≥ 3mm were included in the study.

Exclusion criteria included: 1-Patients with type 2 and type 3 gingival recession according to Cairo et al classification, 2-smokers and pregnant or lactating mothers, 3-presence of antibiotic or periodontal therapy in the last 3 months, and 4-patients with history of systemic diseases.

Clinical examination & preoperative preparation: Before starting any surgical operations, a detailed medical and dental history were obtained from every patient. Then, during the same visit, patients was motivated and educated about self-performed oral hygiene measures. All patients were subjected to a thorough scaling and root planing (SRP) procedures. Preoperative baseline intraoral pictures were taken with a digital camera (D5300, Nikon).

Clinical Parameters: The parameters include: probing depth (PD) [15], clinical attachment loss (CAL) [15], keratinized tissue width (KTW) [16], gingival thickness (GT) [17], recession depth (RD) [18], and evaluation of pain score using visual analogue scale (VAS) [19]. These parameters were evaluated at baseline (T0), 3 months (T1) and 6 months (T2), while VAS score was recorded at 24h, 72h, one week and two weeks after surgery.

Surgical procedures:

Group I: VISTA group [7]:

Under local anaesthesia, VISTA approach initiates with a vestibular access incision. The location of the access incision depends on the sites being treated, wherein midline frenum was considered for maxillary anterior region, frenal area between canine and lateral incisor was considered for maxillary posterior region and in cases of mandibular anterior and posterior regions area between canine and lateral incisor was taken into consideration.

The access incision was made through the periosteum to elevate a subperiosteal tunnel exposing the facial osseous plate as well as root dehiscence. Biomodification of the exposed root surface of the tooth in procedure was done through EDTA gel application (MD-ChelCream-METABIOMED-Pennsylvania-USA). A collagen membrane was then trimmed to fit the dimension of the surgical area and was adjusted to extend at least 3–5 mm beyond the bony dehiscence overlying the root surfaces.

Each tooth was then prepared for attachment of the suture to the tooth. The facial enamel surface of each tooth was briefly acid etched for <5 s, thoroughly washed, and dried. The 5.0 monofilament polypropylene sutures were secured to the facial aspect of each tooth by placing a small amount of flowable composite resin over the knot, thereby effectively preventing apical relapse of the gingival margin during the initial stages of healing. The access incision was then approximated and sutured primarily with collagen membrane using 5.0 polypropylene suture (GMS- Ghatwary Medical GMS- Borg El Arab City-Alexandria-Egypt).

Group II: PST group [9]:

Following local anaesthesia, a horizontal incision of around 2–3 mm with tunnelling instrument (transmucosal periosteal elevator) was inserted through the pinhole and used for blunt dissection. The flap is then extended coronally and horizontally to allow for elevation of two adjacent papillae on each side of the denuded root. The interproximal extension of flap allowed the coronal advancement of the mucogingival complex beyond the cementoenamel junction at the defect site.

Biomodification of the exposed root surface of the tooth procedure was done through EDTA gel (MD-ChelCream-METABIOMED-Pennsylvania-USA) application. For stabilization, a collagen membrane was placed through the pinhole beneath the tunnel. Digital pressure was applied for 5 min to stabilize the advanced flap.

Collagen membrane was sutured with the flap using 5.0 polypropylene suture (GMS- Ghatwary Medical GMS-Borg El Arab City-Alexandria-Egypt).

Postoperative measures:

Ibuprofen 400 mg was prescribed three times per day, along with chlorhexidine digluconate rinses (0.12%) twice daily for 2 weeks with no brushing at surgical site. Moreover, after 14 days patients were recalled for removal of the sutures and given the instructions to maintain good oral hygiene measures and brush the surgical site with a soft toothbrush.

Statistical Analysis

Data were analysed using SPSS (statistical package for social sciences) version 22. Qualitative data will be presented as number and percentage; Quantitative data will be tested for normality by Kolmogrov-Smironv test then described as mean and standard deviation for normally distributed data. The appropriate statistical test was applied according to data type with the following suggested tests: Chi-Square for categorical variable, Student t test and Mann Whitney U test for continuous variables.

Results

A total of twenty subjects were included in this study with an age ranged from 20 to 40 years and were complaining from Cairo's type 1 gingival recession (RT1). They were divided into two main groups; Group I in which 10 patients were enrolled and treated with vestibular incision subperiosteal tunnel access (VISTA) technique in conjunction with collagen membrane, whereas Group II included 10 patients treated with pinhole surgical technique (PST) in conjunction with collagen membrane.

Table 1 illustrates the comparison between VISTA and PST groups as regard to probing depth (PD) at baseline, 3 months, and 6 months. A non-statistically significant difference of PD values was detected at baseline between the two studied groups. Furthermore, a significant decrease in the mean values of PD was noted at 3 and 6 months in both groups. However, a non-statistically significant variation in PD was noticed between VISTA and PST groups after 3 and 6 months.

Table 2 shows comparison between VISTA and PST groups regarding clinical attachment loss at baseline, 3 and 6 months. A non-statistically significant difference was detected at baseline among the two groups. While for both groups a significant decrease in mean CAL was found at 3 and 6 months, a non-statistically significant distinction was recorded between the two groups after 3 and 6 months.

Table 3 exhibits comparison between VISTA and PST group as regard recession depth at baseline, 3 and 6 months. A non-statistically significant gap was detected at baseline between the study groups. For both VISTA and PST groups there was a statistically significant decrease in mean recession depth at 3 and 6 months. Nevertheless, a non-statistically significant difference was detected between groups after 3 and 6 months.

Table 4 demonstrates comparison between VISTA and PST group as regard keratinized tissue width at baseline, 3 and 6 months. At those time intervals, there was a non-statistically significant difference between both groups. Moreover, VISTA and PST groups showed a non-significant change in the value of mean keratinized tissue at 3 and 6 months.

Table 5 illustrates comparison between VISTA and PST group regarding gingival thickness at baseline, 3 and 6 months. Among both groups, there were a non-statistically significant variance at baseline, 3 and 6 months.

Additionally, there was a non-significant increase in mean gingival thickness in VISTA and PST groups at 3 and 6 months.

Table 6 shows comparison between VISTA and PST group as regard VAS score at 24h, 72h, 1 and 2 weeks. A statistically significant distinction was detected between 24h and after 72h in both VISTA and PST groups. In addition, A statistically significant difference was detected after 24h between the two study groups. However, a non-statistically significant difference was recorded after 72h as well as after 1 and 2 weeks.

Discussion:

Gingival recession is a significant aesthetic concern for many patients and may also have functional implications. A variety of therapeutic options are available for addressing isolated or multiple gingival recessions. Selection of the most appropriate treatment modality is influenced by several factors, including the level of the marginal gingiva, width of keratinized gingiva, condition of the alveolar bone and interdental papillae, phenotype of gingival tissue, and the patient's specific aesthetic expectations. Keeping these considerations in mind of the surgeon will ensure a tailored treatment option to achieve optimal functional and cosmetic outcomes [20].

Significant progress has been achieved in surgical methods for managing gingival recession over the past decades, with various adjunctive treatments frequently integrated into coverage procedures. The combination of the coronally advanced flap (CAF) and connective tissue graft (CTG) is widely regarded as the gold standard, delivering root coverage rates of 65% to 98%. However, the technique is not without limitations. Challenges such as discomfort, pain, and delayed healing associated with a secondary surgical site, along with the necessity for highly skilled practitioners, present barriers to its broader application [21-23].

In this regard, new techniques have been suggested to minimize the surgical trauma and increase the vascularization in the recipient site, thereby obtaining better clinical results.[24] One of these procedures would be tunnelling techniques.

The objective of this study was to clinically evaluate the effectiveness of two distinct tunnelling techniques in the treatment of type 1 single isolated gingival recession defect according to Cairo et al classification: the vestibular incision subperiosteal tunnel access (VISTA) technique and the pinhole surgical technique (PST).

Comparative studies between non-resorbable and bioresorbable barrier membranes have reported similar clinical effectiveness. Nevertheless, a major key limitation of using non-resorbable membranes is the requirement for a second surgical intervention to remove them, which can negatively impact healing and overall clinical outcomes. Consequently, bioabsorbable membranes, such as those made of collagen, are generally preferred due to their ability to integrate into the host tissue without necessitating additional procedures [25].

Collagen membranes were utilized in our study to facilitate soft tissue regeneration by offering suture stability, immediate support for the blood clot, and an environment conducive to the early colonization of soft tissue cells. These properties of collagen membranes are integral to enhance healing outcomes, gives some thickness for gingival tissues and ensuring the success of regenerative procedures [25].

Regarding the present study at baseline, there was no statistically significant difference in all clinical parameters (PD, CAL, RD, KTW, GT, and VAS) between the two studied groups to ensure a clear comparison of the treatment outcomes during the follow up periods.

Comparing the follow up periods revealed no statistically significant difference between the two groups in the probing depth. While there was a decrease in mean probing depth within each study group between the baseline and follow up periods.

In both VISTA and PST group there was a statistically significant difference in mean probing depth between baseline and after 3 and 6 months. This can be contributed to the fact that this minimally invasive approach preserves the vascular integrity of the interdental papillae which is a crucial factor in promoting tissue regeneration and healing. Studies have shown that maintaining the vascularity of the papillae supports the rapid revascularization, leading to improved clinical outcomes such as enhanced root coverage and aesthetic integration. These results are consistent with findings reported in previous studies that demonstrated similar reductions in PD and improved periodontal outcomes using VISTA and PST that emphasized its ability to deliver excellent clinical and aesthetic results with minimal invasiveness [20, 26-30].

Comparison of the two techniques showed significant improvements in CAL and recession depth at 3 months and 6 months follow up with non-statistically significant difference between the two groups. While intragroup comparison showed significant difference between baseline and both 3 and 6 months.

The root coverage observed in the present study can likely be attributed to the coronal advancement of the gingival margins beyond the cementoenamel junction (CEJ) and the stabilization of this position through coronal anchorage with sutures. This technique ensures the gingival margins remain in the desired position during the critical healing period. The importance of coronal advancement in achieving successful root coverage has been previously highlighted in the study by Pini Prato et al. [31], which emphasized its role in optimizing surgical outcomes for gingival recession treatment.

In VISTA technique, there was a decrease in median CAL and median recession depth between baseline and 3 months follow up period and after 6 months. This is agreeing with several studies which concluded that the VISTA technique resulted in stable outcomes with no recurrence of gingival recession during the study period. And contributed these results to the minimal invasion characteristics that helps preserve the delicate interdental papillae which ensures better vascularization and reduces the risk of tissue ischemia, leading to more favourable healing conditions. In the studies, this preservation was associated with a reduced risk of complications like tissue necrosis and graft failure, resulting in high patient satisfaction and minimal recurrence of recession [26, 32, 33]

While in the pinhole group, there was a decrease in median CAL as well as median recession depth with a statistically significant difference between baseline and both 3 and 6 months follow up periods. these outcomes were also supported by Chao[9] who concluded that PST is capable of increasing the tissue volume and give stable predictable results if the presented tissue thickness is 0.8–1 mm minimally. This may be contributed to the fact that in PST, there is no elevation of the flap and hence the wholesome soft-tissue thickness available at the host bed is completely utilized [34]. This is also in consensus with other researchers who demonstrated that in PST there is an additional biologic, esthetic, and time advantage where there is no disruption of the lateral vascular supply, no scar formation, and reduced time [28, 30, 35].

There was no statistically significant difference in keratinized tissue width (KTW) between the two groups or within each group across the follow-up periods. This result can be attributed to the adoption of minimally invasive incision techniques, which minimize the likelihood of damaging gingival tissue. Furthermore, these approaches help maintain the integrity and blood supply of the delicate papillae, facilitating a more effective healing process, thus maintaining the KTW [36, 37].

Additionally, the present study observed no increase in the width of keratinized tissue, which can be attributed to the absence of keratinized tissue grafts in the treatment protocol. This result is inconsistent with findings from previous studies such as Kuis et al [38] that emphasize the critical role of keratinized tissue grafts, such as free gingival grafts or connective tissue grafts, in augmenting the zone of keratinized tissue.

The lack of KTW gain suggests that while techniques like VISTA and PST are effective in achieving root coverage and improving gingival thickness, they are not specifically designed to address the augmentation of keratinized

tissue. These minimally invasive procedures focus on repositioning existing soft tissue to cover exposed roots, rather than introducing new keratinized tissue.

These findings underscore the importance of tailoring surgical approaches to the specific clinical objectives of each case. If increasing the width of keratinized tissue is a priority, incorporating grafting techniques may be necessary. Conversely, for cases focused on esthetic root coverage and soft tissue enhancement, minimally invasive procedures like VISTA and PST remain highly effective options.

This finding contradicts the study conducted by Reddy [29], which reported an increase in the width of keratinized tissue. According to that study, this increase could be attributed to the contribution of the periodontal ligament through granulation tissue formation and the eventual re-establishment of mucogingival junction at its genetically predetermined position. The process of MGJ resettlement appears to play a critical role in the observed increase in KTW. However, the exact duration required for the MGJ to fully resettle in its original position and contribute to the increase in KTW remains uncertain and warrants further investigation [39] .

Regarding gingival thickness (GT), no significant difference was observed between the study groups. However there was an increase in the mean gingival thickness from baseline to follow-up periods in both groups. This can be attributed to the use of collagen membranes, which have an excellent capacity for soft tissue induction. The porosity of the collagen matrix creates a thick, porous layer that facilitates the growth of soft tissue into it, promoting tissue thickening over time [40].

This result aligns with the findings of other studies, where the use of a collagen matrix in combination with a coronally advanced flap led to a 1 mm increase in gingival thickness. This is consistent with our study, as both VISTA and PST are variations of coronally advanced techniques. Additionally, the study which utilized a collagen matrix for treating gingival recession, yielded similar results, further supporting the effectiveness of collagen matrices in promoting gingival thickening [41, 42].

A comparison of the two groups regarding the VAS scores showed a significant reduction in mean scores after 24 hours in both groups, with no statistically significant difference observed after 72 hours as well as after 1 and 2 weeks. Intraoperative discomfort was minimal, and postoperative symptoms, including bleeding, swelling, and pain, were mild and short-lived. Additionally, aesthetic outcomes, such as colour match and tissue blending, were favourable. These outcomes can be attributed to the minimally invasive nature of the techniques, limited use of sutures, and the immediate aesthetic improvements that are noticeable to patients. Furthermore, these approaches avoid compromising vascular supply by eliminating vertical releasing incisions, prevent scar formation, and reduce overall surgical time [35].

It was revealed that the VISTA technique has been associated with fewer postoperative complications, including swelling, pain, and bleeding. Because the procedure is minimally invasive and involves less manipulation of the gingival tissues, there is less disruption to the tissue and a reduced risk of infection or graft failure. The use of a single incision and subperiosteal tunnelling also minimizes the chances of flap dehiscence, a common complication in traditional techniques [26, 32].

Moreover, in accordance with our results regarding PST, A retrospective study demonstrated effectiveness of the Pinhole Surgical Technique (PST) in treating Miller's Class I and II gingival recession reported a comparable results where postoperative complications were minimal with cases experiencing mild pain, slight bleeding, and postoperative swelling, all of which subsided within the first two days. Additionally, the study highlighted significant patient satisfaction, particularly in terms of aesthetic outcomes, with 95% of patients expressing high levels of satisfaction [29].

Conclusion:

It can be concluded that VISTA and PST when combined with collagen membrane were successful in management of Cairo's type 1 single isolated gingival recession defects. Both groups recorded statistically significant improvements from baseline in decreased recession depth, gain in clinical attachment levels and increase in gingival thickness. In addition, collagen membrane can be used as a graft material with the clinical advantage of increasing gingival thickness, avoiding a donor site and a major decrease in patients' discomfort after operation.

Limitations and recommendations:

Due to the short-term follow-up period (3 and 6 months), the focus has primarily been on single isolated gingival recession defects, and a limited number of randomized clinical trials evaluating the use of VISTA and PST along with collagen membrane in treatment of gingival recession, as most reported studies in the literature were case reports and case series. Therefore, we recommend conducting further multicentre randomized clinical trials that consider both localized and multiple gingival recession defects with longer follow-up periods and larger sample sizes to assess the clinical outcomes of VISTA and PST more thoroughly in the treatment of gingival recession.

References:

1.Periodontology AAo. Con-sensus report on mucogingival therapy. Proceedings of the World Workshop in Periodontics. Annals of Periodontology 1, 702–706. 1996.
2.Zalkind M HN. Alternative method of conservative esthetic treatment for gingival recession. J Prosthet Dent. 1997 Jun;77(6):561-3. doi: 10.1016/s0022-3913(97)70094-5. PMID: 9185045.
3.Jain SK, Harjit & Aggarwal, Ridhi. (2017). . Classification systems of gingival recession: An update. Indian Journal of Dental Sciences. 9. 52. 10.4103/0976-4003.201632. .
4.Cairo F PU, Nieri M. Treatment of gingival recession with coronallyadvanced flap procedures: a systematic review. J Clin Periodontol 2008; 35(Suppl. 8): 136–162.
5.Dandu SR MK. Multiple Gingival Recession Defects Treated with Coronally Advanced Flap and Either the VISTA Technique Enhanced with GEM 21S or Periosteal Pedicle Graft: A 9-Month Clinical Study. Int J Periodontics Restorative Dent. 2016 Mar-Apr;36(2):231-7. doi: 10.11607/prd.2533. PMID: 26901301.
6.Thalmair T FS, Wachtel H. Coverage of multiple mandibular gingival recessions using tunnel technique with connective tisuue graft: a prospective case series. Int. J Periodontics Restorative Dent 2016;36(6):859-67.
7.HH. Z. Minimally invasive treatment of maxillary anterior gingival recession defects by vestibular incision subperiosteal tunnel access and platelet-derived growth factor BB. Int J

Periodontics Restorative Dent 2011;31:653-60.
8.Jain KS VS, Gupta SJ, Sharma N, Khare M, Nair MM. Minimally invasive treatment of gingival recession by vestibular incision subperiosteal tunnel access technique with collagen membrane and advanced platelet-rich fibrin: A 6-month comparative clinical study. J Indian Soc Periodontol. 2021 Nov-Dec;25(6):496-503.
9.JC. C. A novel approach to root coverage: The pinhole surgical technique. Int J Periodontics Restorative Dent 2012;32:521-31.
10.Trombelli L SG, Scapoli C, Calura G. Healing response of human buccal gingival recessions treatedwith expanded polytetrafluoroethylene membranes. Aretrospective report. J Periodontol1995;66:14-22.
11.Vergara JA QC, Nasjleti CE, Caffesse RG. Vascular response to guided tissue regeneration proce-dures using non-resorbable and bioabsorbable mem-branes in dogs. J Periodontol1997;68:217-224.
12.Roccuzzo M LM, Corrente G, Gandolfo S. Comparative study of a bioresorbable and a non-resorbablemembrane in the treatment of human buccal gingivalrecessions. J Periodontol1996;67:7-14.
13.Zucchelli G CC, De Sanctis M, Calandriello M. Mucogingival versus guided tissue regeneration proce-dures in the treatment of deep recession-type defects.J Periodontol1998;69:138-145.
14.Shieh AT WH, O'Neal R, Glickman GN, MacNeil RL. Development and clinical evaluation of a root coverage procedure using a collagen barrier membrane. J Periodontol. 1997 Aug;68(8):770-8.
15.GC. A. Clinical evaluation of periodontal diseases.Periodontol 2000 1995;7:39-53.
16.Bhatia G KA, Khatri M, Bansal M, Saxena S. Assessment of the width of attached gingiva using different methods in various age groups: A clinical study. J Indian Soc Periodontol. 2015 Mar-Apr;19(2):199-202.

17.Anand PS BA, Shenoi BR, Kamath KP, Kamath NP, Anil S. Width and thickness of the gingiva in periodontally healthy individuals in a central Indian population: a cross-sectional study. Clin Oral Investig. 2022 Jan;26(1):751-759. doi: 10.1007/s00784-021-04053-w. Epub 2021 Nov 16. PMID: 34783916.
18.Kuralt M GR, Fidler A. The precision of gingival recession measurements is increased by an automated curvature analysis method. BMC Oral Health. 2021 Oct 7;21(1):505.
19.Hayes MH. Experimental developement of the graphics rating method. Physiol Bull, 1921, 18, pp.98-99.
20.Mohamed AM, Lama. Comparative clinical study between Tunnel and VISTA approaches for the treatment of multiple gingival recessions with acellular dermal matrix allograft. Egyptian Dental Journal 2020;66:247-259. .
21.F. C. Periodontal plastic surgery of gingival recessions at single and multiple teeth. Periodontol. 2000;2017(75):296–316.
22.Roccuzzo M, Bunino, M., Needleman, I.& Sanz, M. Periodontal plastic surgery for treatment of localized gingival recessions: a systematic review.Journalof Clinical Periodontology2002;29(Suppl. 3),178–194.
23.John V LL, Rasperini G, Kim DM, Neiva R, Greenwell H, Dibart S, Sanz M, Scheyer ET. Periodontal Soft Tissue Non-Root Coverage Procedures: Practical Applications From the AAP Regeneration Workshop. Clin Adv Periodontics. 2015 Feb;5(1):11-20.
24.Fernández-Jiménez A E-FR, García-De-La-Fuente AM, Marichalar-Mendia X, Aguirre-Urizar JM, Aguirre-Zorzano LA. Comparative study of the modified VISTA technique (m-VISTA) versus the coronally advanced flap (CAF) in the treatment of multiple Miller class III/RT2 recessions: a randomized clinical trial. Clin Oral Investig. 2023 Feb;27(2):505-517.
25.Kimble KM ER, Soehren S, Shyr Y, Wang HL. Treatment of gingival recession using a collagen membrane with or without the use of demineralized freeze-dried bone allograft for space maintenance. J Periodontol. 2004 Feb;75(2):210-20.
26.Chatterjee A SE, Gundanavar G, Subbaiah SK. Treatment of multiple gingival recessions with vista technique: A case series. J Indian Soc Periodontol. 2015;19:232–5. doi: 10.4103/0972-124X.145836.
27.Mansouri S MO, Torabi N, Ghafari K. Vestibular incisional subperiosteal tunnel access versus coronally advanced flap with connective tissue graft for root coverage of Miller's class I and II gingival recession: A randomized clinical trial. J Adv Periodontol Implant Dent. 2019;11:12–20.
28.Agarwal MC KG, Manjunath RG, Karthikeyan SS, Gummaluri SS. . Pinhole surgical technique – A novel minimally invasive approach for treatment of multiple gingival recession defects: A case series. Contemp Clin Dent 2020;11:97-100.
29.Reddy SSP. Pinhole surgical technique for treatment of marginal tissue recession: a case series, J. Indian Soc. Periodontol. 21 (2017) 507–511. .
30.P. Anuroopa SA, P. Naidu, S. Savita. . Treatment of gingival recession by a novel pinhole technique- a report of page 3 of 5 two cases, J. Dent. Oral Disord. Ther. 6 (2018) 1–5. .
31.Pini Prato GP BC, Nieri M, et al. Coronally advanced flap: thepost-surgical position of the gingival margin is an important factor forachieving complete root coverage. J Periodontol. 2005;76:713-722.
32.Rajeswari SR TM, Kumar ABT, Ravishankar PL, Rajula MPB, Almeida L. Patient-centered comparative outcome analysis of platelet-rich fibrin-reinforced vestibular incision subperiosteal tunnel access technique and Zucchelli's technique. J Indian Soc Periodontol. 2021 Jul-Aug;25(4):320-329.
33.Gupta G PK, Bansal M, Khatri M, Kumar A. Platelet-rich fibrin–reinforced vestibular incision subperiosteal tunnel access technique for recession coverage. J Clin Adv Periodont. 2015;5:248–53.
34.Baldi C P-PG, Pagliaro U, Nieri M, Saletta D, Muzzi L, et al. Coronally advanced flap procedure for root coverage. Is flap thickness a relevant predictor to achieve root coverage? A 19-case series. J Periodontol. 1999;70:1077–84.
35.Zucchelli G MM, Mazzotti C, Marzadori M, Montebugnoli L, De Sanctis M. Coronally advanced flap with and without vertical releasing incisions for the treatment of multiple gingival recessions: A comparative controlled randomized clinical trial. J Periodontol 2009;80:1083-94.
36.Reddy S PM, Bhowmik N, Singh S, Pandit HR, Vimal SK. Vestibular incision subperiosteal tunnel access (VISTA) with platelet-rich fibrin (PRF) and connective tissue graft (CTG) in the management of multiple gingival

recession- A case series. Int J Appl Dent Sci 2016; 2: 34-37.
37.DH. M. Treatment of gingival recession with a modified tunnel technique and an acellular dermal connective tissue allograft. Pract Proced Aesthet Dent. 2001; 13(1): 69-74.
38.Kuis D, Sciran, I., Lajnert, V., Snjaric, D., Prpic, J., Pezelj-Ribaric, S. and Bosnjak, A. Coronally Advanced Flap Alone or With Connective Tissue Graft in the Treatment of Single Gingival Recession Defects: A Long-Term Randomized Clinical Trial. Journal of Periodontology,2013, 84: 1576-1585.

39.Zucchelli G DSM. Long-term outcome following treatment of multiple miller class I and II recession defects in esthetic areas of the mouth. J Periodontol. 2005;76:2286–92.
40.Dominiak MM, D.; Puzio, M.; Gedrange, T. Clinical evaluation of the effectiveness of using a collagen matrix in gingival recession coverage-pilot study. J. Stoma 2012, 65, 184–197.
41.Cardaropoli D. TL, Roffredo A., Gaveglio L. Treatment of gingival recessions defects using coronally advanced flap with a porcine collagen matrix compared to coronally advanced flap with connective tissue graft: A randomized controlled clinical. J. Periodontol. 2012;83:321–328. .
42.Pedowska M PM, Chałas R, Ptasiewicz M. The Use of Collagen Matrix in the Treatment of Gingival Recession-A Pilot Study. J Pers Med. 2022 Nov 15;12(11):1902. doi: 10.3390/jpm12111902. PMID: 36422078; PMCID: PMC9695200.

Table 1: Probing depth (PD; mean ±SD) between groups at different time intervals:

Probing depth (mm)	VISTA n=10	PST n=10	p value
Baseline	1.35±0.16	1.47±0.21	NS
3 months	1.16±0.14	1.25±0.18	NS
6 months	1.14±0.12	1.22±0.15	NS
Comparison	*p1<0.001*, p2<0.001* p3>0.05*	*p1<0.001*, p2<0.001* p3>0.05*	

Student t test and Paired t test were used for analysis.

p1: difference between baseline and after 3 months, p2: difference between baseline and after 6 months

*p3: difference between 3 and 6 months, *Statistically significant, NS=non-significant (p>0.05).*

Table 2: Clinical attachment loss (CAL; mean ±SD) between groups at different time intervals:

Clinical attachment loss (mm)	VISTA n=10	PST n=10	p value
Baseline	4.25±0.45	3.82±0.34	NS
3 months	0.75±0.64	0.56±0.32	NS
6 months	0.90±0.83	0.85±0.63	NS
Comparison	p1<0.01*, p2<0.01* p3>0.05	p1<0.01*, p2<0.01* p3>0.05	

Mann Whitney U test and Wilcoxon signed rank test were used for analysis.

p1: difference between baseline and after 3 months, p2: difference between baseline and after 6 months,

*p3: difference between 3 and 6 months, *Statistically significant, NS=non-significant (p>0.05).*

Table 3: Recession depth (RD; mean ±SD) between groups at different time intervals:

Recession Depth (mm)	VISTA n=10	PST n=10	p value
Baseline (T0)	2.75±0.27	2.53±0.32	NS
3 months (T1)	0.25±0.36	0.34±0.56	NS
6 months (T2)	0.32±0.49	0.27±0.35	NS
Comparison	p1<0.01*, p2<0.01* p3>0.05	p1<0.01*, p2<0.01* p3>0.05	

Mann Whitney U test and Wilcoxon signed rank test were used for analysis.

p1: difference between baseline and after 3 months, p2: difference between baseline and after 6 months

*p3: difference between 3 and 6 months, *Statistically significant, NS=non-significant (p >0.05).*

Table 4: Keratinized tissue width (KTW; mean ±SD) between groups at different timepoints:

Keratinized tissue width (mm)	VISTA n=10	PST n=10	p value
Baseline (T0)	5.16±2.38	5.99±2.75	NS
3 months (T1)	5.16±2.36	5.99±2.54	NS
6 months (T2)	5.16±2.34	5.99±2.43	NS
Comparison	p1=NS, p2=NS p3=NS	p1=NS, p2=NS p3=NS	

Mann Whitney U test and Wilcoxon signed rank test were used for analysis.

p1: difference between baseline and after 3 months, p2: difference between baseline and after 6 months

p3: difference between 3 and 6 months, NS=non-significant (p >0.05).

Table 5: Gingival thickness (GT; mean ±SD) between groups at different timepoints:

Gingival thickness (mm)	VISTA n=10	PST n=10	p value
Baseline (T0)	1.81±0.42	1.83±0.46	NS
3 months (T1)	1.90±0.65	1.95±0.55	NS
6 months (T2)	1.88±0.57	1.91±0.58	NS
Comparison	p1=NS, P2=NS p3=NS	p1=NS, p2=NS p3=NS	

Student t test and Paired t test were used for analysis.

p1: difference between baseline and after 3 months, p2: difference between baseline and after 6 months

p3: difference between 3 and 6 months, NS=non-significant (p >0.05).

Table 6: Visual analogue scale score (VAS; mean ±SD) between groups at different timepoints:

VAS score	VISTA n=10	PST n=10	p value
24h	4.90±1.19	3.70±1.25	p<0.05*
72h	2.70±0.94	2.90±0.57	p=NS
1 week	0	0	
2 weeks	0	0	
	p<0.001*	p<0.05*	

Student t test and repeated measures ANOVA test were used in the analysis.

**Statistically significant.*

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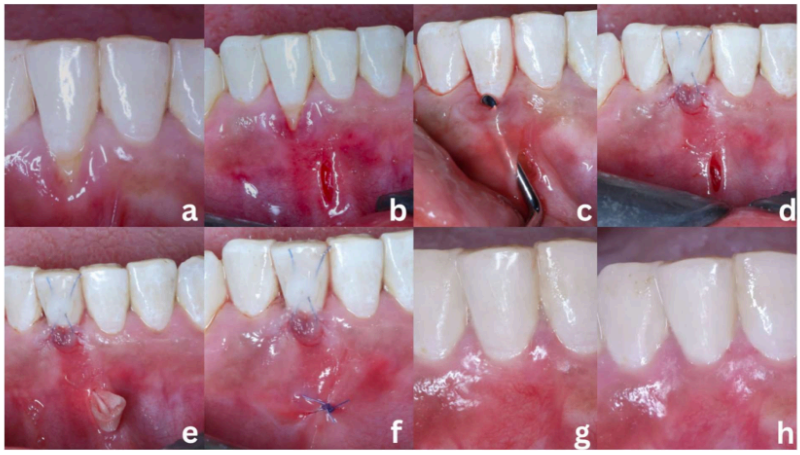

Fig.1 VISTA case showing a) baseline, b) VISTA incision, c) tunnel preparation, d) gingival margin repositioning, e) membrane insertion, f) incision suturing g) 3-month follow-up, h) 6-month follow-up.

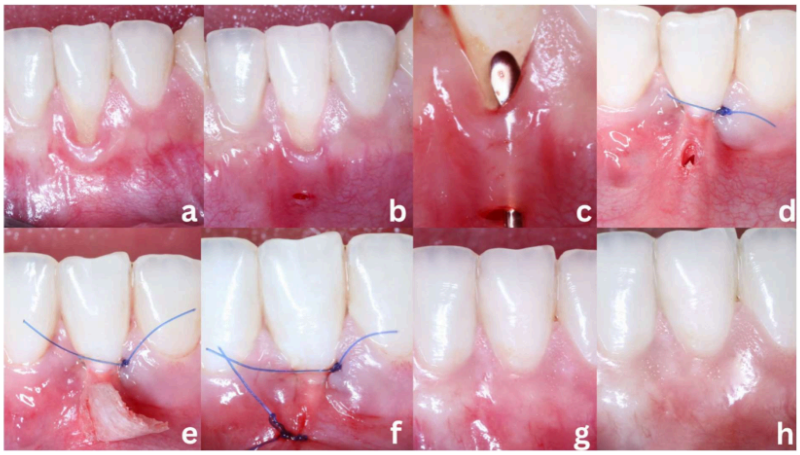

Fig.2 PST case showing a) baseline, b) PST incision, c) tunnel preparation, d) gingival margin repositioning, e) membrane insertion, f) incision suturing g) 3-month follow-up, h) 6-month follow-up.

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